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(54) **Electrostatographic processing system.**

(57) An electrostatographic processing system for obtaining enhanced copy quality in which transfer to a support material is effected by a corona generator (48) having an electrode (81) and the developer mixture includes toner particles having a particle size distribution with a median diameter by volume of about 12 microns with not more than 8%, preferably 1 to 5% by volume of the particles having a diameter greater than 20 microns and not more than 20%, preferably 0.5 to 13.5%, by number of the particles having a diameter less than 5 microns. For best results the ratio of toner content to carrier is such that there is a solid area reflection optical density of fixed images of about 1.3. Further improvement in copy quality is achieved by also including a bias transfer roll (40) at the transfer station and by utilizing a fuser having a pressure roll in contact with a conformable heated fuser roll.

EP 0 010 375 A1

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Croydon Printing Company Ltd.

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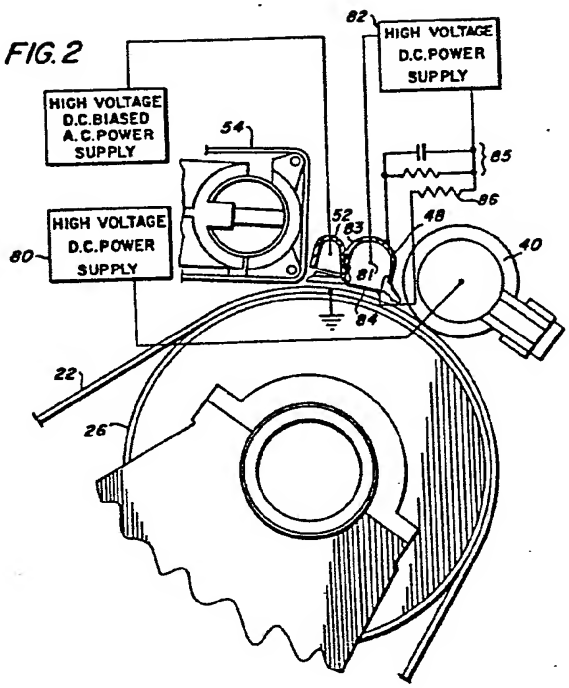
FIG. 2



HIGH VOLTAGE D.C.BIASED A.C.POWER SUPPLY
HIGH VOLTAGE D.C.POWER SUPPLY
HIGH VOLTAGE D.C.POWER SUPPLY
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ELECTROSTATOGRAPHIC PROCESSING SYSTEM

The present invention relates to an electrostatographic processing system for producing high quality electrostatically developed images by the transfer of these images to support material, such as sheets of plain paper.

In a conventional form of electrostatographic processing, such as xerography, a xerographic plate comprising a layer of photosensitive insulating material affixed to a conductive backing is used to support electrostatic latent images. In the xerographic process, the photosensitive surface is electrostatically charged, and the charged surface is then exposed to a light pattern of the image being reproduced to thereby discharge the surface in the areas where light strikes the surface. The undischarged areas of the surface thus form an electrostatic charge pattern (an electrostatic latent image) conforming to the original pattern. The latent image is then developed by contacting it with developing material having a finely divided electrostatically attractable powder referred to as "toner". Toner is held on the image areas by the electrostatic charge on the surface. Where the charge is greater, a greater amount of toner is deposited. Thus, a toner image is produced in conformity with a light image of the copy being reproduced. Generally, the developed image is then transferred to a suitable support material (e.g. paper), and the image is affixed thereto to form a permanent record of the original document.

The developing material normally comprises relatively large carrier beads, which may be insulatively coated metal, and the relatively smaller dry ink particle toner. Due to the triboelectric relationships between the two, the smaller toner particles attach themselves to the carrier in great numbers. As the developing material is brought into contact with the photoreceptor surface, electrostatic charges on the photoreceptor tends to separate the toner particles from the carrier and deposit the same onto the photoreceptor in accordance with the latent image charge pattern. The carrier, some of which may be depleted of toner or partially depleted, is returned to a developer sump for replenishing with toner particles.

In the practice of xerography, the support material is caused to move

in synchronized contact with the photosensitive surface during the transfer operation, and an electrical potential opposite from the polarity of the toner is applied to the side of the paper remote from the photosensitive surface to electrostatically attract the toner image from the surface to the paper.

Some modern high speed duplicating machines utilize a single transfer device such as an electrically biased transfer roll to effect the image transfer. Although a biased transfer roll system performing as the sole transfer device effects good to excellent copy quality, certain copy quality deficiencies may be present. The most notable of these is the difficulty of transferring very small sizes of toner particles, say on the order of 3 to 10 micron diameter sizes. This inability is apparent because of the geometry of a roller type electrostatic transfer device. As the surface of the roller approaches the nip at which transfer of toner particles occur, there is a tendency for voltage breakdown if the transfer potential is too high. Lowering of the transfer voltage to avoid voltage breakdown, will limit the size of toner particles which can be made to adhere to support material.

The toner particles contemplated for the purpose of this invention must be related to a specific arrangement of image transfer devices utilized during the xerographic processing step of transferring. The present invention contemplates a transfer system which includes a transfer corona generating device. The prior art teaches an electrostatographic processing system having developer mixture of finely-divided toner particles electrostatically clinging to the surface of carrier particles; a corona device for uniformly charging the photosensitive surface prior to produbtion of an electrostatic latent image; a development apparatus for developing the latent image; a transfer station whereat support material is placed into contact with the photosensitive surface bearing a developed image for receiving the same, said transfer station having a corona generating means having an electrode adapted to spray ions upon the adjacent side of the support material for effecting transfer of toner particles from the developed image to the support material.

The present invention is characterized in that the toner particles have a particle size distribution with a median diameter by volume of about 12.0 microns, with not more than 8% by volume having a diameter greater than 20 microns and not more than 20% by number having a diameter less than 5 microns. By providing a developer

mixture including toner particles sized as described above in conjunction with electrostatographic apparatus in which the transfer device is a corona generating device, it has been found that unexpectedly high quality images are obtained on the support material with good toner transfer. Still better results are achieved if the course particle content is limited to 1 to 5% and the fine particle content is limited to 0.5 to 13.5%.

It has also been found that contrary to the current practice, even better results are achieved if the ratio of toner content to carrier is such that there is a solid area reflection optical density of fixed images on the support material of about 1.3.

To enhance toner transfer especially in areas of the transfer material wherein the corona generating device is not applied, or is unable to effect efficient transfer, there is according to a preferred feature of the invention combined therewith an electrically biased transfer roller. The electrical biases on each of these transfer devices and the form in which they take are effectively related to the sizes of toner particles on either side of the size distribution range. The transfer device in the form of a corona generating device and the electrical potential impressed thereon is suitable to effect transfer of the smallest toner particles say down to approximately 3 microns in diameter. A corona generating device of the type contemplated has one or more electrode wires which when energized with the suitable potential sprays ions on the back side of the sheet of paper during the transfer step. It is to be understood that a corona generating device of this type is also capable of effecting the transfer of larger toner particles including the sizes disclosed herein. The bias transfer roller and the electrical potential impressed thereon acting in unison with the corona generating device enhances transfer efficiency and is able to effect transfer of more of the larger toner particles say from 10 microns to somewhat larger sizes. In addition, the biased roller will effect toner transfer in situations wherein the corona generating device is unable to effect transfer or complete transfer such for example at the leading edge of each copy sheet.

As will be described hereinafter, the average size of the diameters of the toner particles is shifted downwardly by the classification of toner particles wherein a large percentage of the larger toner particles are removed. The resultant mixture provides a larger percentage of smaller particles and

a smaller average diameter size. In effect, there is a finer toner distribution and the transfer of this distribution with high transfer efficiency is accomplished by the above disclosed arrangement of transfer devices.

From the foregoing it will be appreciated that according to this preferred feature the present invention contemplates the integrated action of certain parameters of toner particles with the utilization of two forms of transfer devices having various electrical biases and potentials utilized to effect the transfer of both small and larger diameter toner particles thereby providing an efficient processing system for improving the quality of copy.

It is known to use both a biased transfer roller and a corona generating device but not to correlate their use with the size of toner particles and any of the processing steps utilized in electrostatographic processing. In the US Patent No 4027960, there is a specific disclosure of a dual transfer system and circuitry therefore. However, the devices in this system are mainly directed to minimizing various copy quality deficiencies disclosed in that patent and are not correlated to the parameters of the components of developing material.

According to a further preferred feature of the invention, the system includes an image fixing station comprising a fusing apparatus having a pressure roller in contact with heated fuser roller to form a nip through which the support material is transported, said fuser roller having an outer layer made from material being conformable with toner height configuration and said pressure roller being deformable at the nip during fusing contact with said fuser roller. By this means copies can be obtained which are even further improved and have little or no quality defects such as blur, hollow characters or other causes of image degradation.

For a better understanding of the invention, an embodiment will now be described by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of an electrostatic type reproduction machine embodying the principles of the present invention;

Fig. 2 is a fragmentary, enlarged view of the transfer station of the machine shown in Fig. 1 and associated circuitry, and

Fig. 3 is a cross section of the toner fixing apparatus utilized in the present invention.

The processing system for the present invention envisions the use of developer material within what is disclosed and claimed in the U.S. Patent No. 3,969,251, the disclosure of which is hereby incorporated by reference. Specifically, the present processing system contemplates the use of toner having a particle size in the range of about 5 microns to about 20 microns, and coated ferrite carrier materials, having a volume average particle diameter of about 100 microns. It has been found that the developer materials of this classification when used in the present invention provide very improved results over conventional developer materials. Better than expected results were obtained when the toner materials had a particle size distribution with a median diameter by volume of about 12.0 microns against the larger median in conventional use, that the coarse content by volume not more than a range of 0-8.0 percent greater than about 20 microns, and that the fine content by number not more than about 20.0 percent less than 5 microns. Still better results were achieved with the coarse content at a percent range of 1.0 to 5.0 and a fine content with a percent range of 0.5 to 13.5.

For a general understanding of an electrostatic reproduction machine in which the present invention may be incorporated, reference is made to Fig. 1. As in all electrostatic reproduction machines of the type illustrated, a light image of an original is projected onto the photosensitive surface of a xerographic plate to form an electrostatic latent image thereon. Thereafter, the latent image is developed with an oppositely charged developing material comprising carrier beads and toner particles triboelectrically adhering thereto to form a xerographic powder image corresponding to the latent image on the photsensitive surface. The powder image is then electrostatically transferred to a transfer member such as a sheet of paper to which it may be fixed by a fusing device whereby the toner image is caused permanently to adhere to the transfer member.

In the illustrated machine 10, an original 12 to be copied is placed upon a transparent support platen 14 fixedly arranged in an illumination assembly

indicated generally by the reference numeral 16. While upon the platen, the illumination assembly flashes light rays upon the original, thereby producing image rays corresponding to the informational areas on the original. The image rays are projected by means of an optical system 18 to an exposure station 20 for exposing the surface of a moving xerographic plate in the form of a flexible photoconductive belt or photoreceptor 22. In moving in the direction indicated by the arrow, prior to reaching the exposure station 20, that portion of the belt being exposed would have been uniformly charged to approximately +800 to +950 volts by a corona generating device 24 located at a belt run extending between the belt supporting rollers 26 and 28. The exposure station extends between the roller 28 and a third roller 30.

The exposure of the photosensitive surface of the belt to the light image discharges the surface in the areas struck by light whereby an electrostatic latent image remains on the belt in image configuration corresponding to the light image projected from the original on the support platen. As the belt continues its movement, the latent image passes around the roller 30 and through a developing station 32 where a developing apparatus indicated generally by the reference numeral 34 is positioned. The developing apparatus 34 preferably comprises a plurality of magnetic brushes 35 which carry developing material to the surface of the upwardly moving belt 22. As the developing material is applied to the belt, toner particles in the development material are electrostatically attracted to the charged photosensitive surface to form a powder image (an electrostatic developed image). The brushes 35 for the apparatus 34 are electrically connected to a d.c. power supply 36 by way of a bus bar 37 to be electrically biased in accordance with the electrical field needed between the brushes and the photoreceptor 22. A variable resistance device 38 is connected to the circuit to permit variation in the magnetic brush biasing in accordance with the particular toner/carrier electrostatic characteristics and the electrostatic charge of the latent image being developed. The apparatus 34 is electrically insulated from the remaining structure of the machine so that the electrically conductive carrier particles do not short out, or cause electrical shorts relative to the machine.

The developed electrostatic image is transported by the belt 22 to a transfer station 39 where a sheet of paper is moved at a speed in synchronism with the moving belt in order to effect transfer of the developed image.

Located adjacent the transfer station 39 is an electrically biased transfer roller 40 which is rotatably arranged on the frame of the machine to receive individual sheets from a sheet conveyor 41 of a transport mechanism generally indicated by the reference numeral 42 and to guide each sheet to the transfer station 39.

The sheet transport mechanism 42 transports sheets of paper seriatim from a paper supply system indicated generally by the reference numeral 44 to the developed image on the belt as the same is carried around the roller 26.

At the transport station 39, the main transfer device 48 in the form of a corona generating device having one or more corona emitting wires is positioned to spray ions on the back side of a sheet of paper as the latter is moved or fed between the photoreceptor belt 22 and the device 48. The transfer roller 40 is supplied with electrical potential from a suitable d.c. source having a polarity opposite of the toner particles being transferred. Transfer of toner particles by the roller 40 is effected as the roller comes in contact with the side of a sheet of paper opposite that to which the developed image is to be transferred. The corona emitting wire for the device 48 is electrically biased by means of a supply circuit with sufficient voltage to effect ion spray upon the adjacent side of each sheet of paper passing therebeneath so that the developed image on the belt may be electrostatically attracted to its adjacent side of the sheet of paper as the latter is brought into contact therewith.

As a sheet emerges from the transfer station 39, a charge is deposited on the leading edge thereof by a detack corona generating device 52 to lessen the electrostatic attraction between the belt 22 and the sheet so that the latter can be removed by a vacuum stripping and transport mechanism 54. With only the leading edge being so charged for stripping purposes, there is less charge being applied to the sheet by this detack device so toner disturbance is eliminated. The sheet is thereafter retained on the underside of the vacuum stripping transport mechanism 54 for movement into a fuser assembly indicated generally by the reference numeral 56 wherein the powder image on the sheet is permanently affixed thereon. After fusing, the finished copy is discharged at a suitable point for collection. The toner particles remaining as residue on the belt 22 are carried by the belt to a rotating brush cleaning apparatus 58. The cleaning apparatus 58 cooperates with a corona

discharge device 60 for neutralizing charges remaining on the untransferred toner particles before being removed by the rotating brush 58.

The fusing apparatus 56 envisioned in this invention is of the hot, soft roller type comprising a lower heated roller 68 having a Quartz lamp 69 supported along the axis thereof, and an upper pressure roller 70. The lamp 69 serves as a source of thermal energy for the fusing apparatus. As shown in Fig. 3, the heated roller 68 includes a metallic core 90, which surrounds the lamp 69. The outer surface of the core 90 is coated with an "abhesive" or offsetting material 91, preferably a fluoroelastomer based on the copolymer of vinylidene fluoride and hexafluoropropylene. A preferred example of this coating material is Viton® material (trademark of the E.I. DuPont Corp) and at a thickness in the range of 7-10 mils. For additional information regarding the use of Viton® as a fuser roller material, reference is made of the description in the publication "Product Licensing Index, Research Disclosures", July 1972, pages 72, 73. A suitable offset preventing oil, such as silicone oil, may be applied to the fuser roller surface during fusing operation.

The pressure roller 70 includes a metallic core 92 having a thick organic rubber outer layer 93. The layer 93 may be of the material known as EPDM under the tradename EPCAR 346 of the B.F. Goodrich Corp. and having an outer thin sleeve 94 of PFA Teflon® material, a trademark of the E.I. DuPont Corp. For additional information of these materials for a pressure roller, reference is made to U.S. Patent No. 4,083,092 which discloses a pressure roller envisioned for use in the present invention. When in operative contact, the rollers 68, 70 are held against one another under pressure.

The materials 91 and 93 are of such a hardness as to produce a relatively large deformed nip area 95 having a width approximately 1/5 the diameter of the rollers. As shown in Fig. 3, the pressure is such as to deform the rubber in the pressure roller. The coating 91 is sufficiently thick and yet conformable as to conform to the pile heights of toner images-to-be-fused whether the piles comprise large toner particles or small toner particles as envisioned in the present invention. In conventional fuser roller coatings made for example from Teflon®, the hardness of the coating prevents adequate conformability to the various heights of toner piles in images and also to the variations of toner sizes. When images-to-be-fused comprise variations of pile heights, generally only the higher piles come in contact with the fuser roller surface leaving much of the lower heights out of contact with the fuser

roller. This results in high graininess of fused images and, for solid area coverage, glossiness with or without the accompaniment of images which can be smeared by touching.

The combination of the deformability of the pressure roller 70 along with the conformability of the fuser roller 68 with the developing mixture to be discussed below has produced very high quality output copies not available with the separate uses of these features.

It has been found that relatively small toner particles, or fine toner in a developer mixture tend to effect high quality, line copy. However, this phenomenon is accompanied by the production of what is known as "hollow characters", that is, some toner particles may occasionally be depleted from the central regions of various letters. It is very important then to determine diameter size of such toner particles and to ocntrol the distribution of these small size particles.

It has also been found that the use of too large a diameter for too many toner particles, in other words, coarse content, will be incapable of producing quality resolution as images will appear blurred. Resolution may be enhanced by controlling the course content so that a very narrow percent range by volume for particle size distribution over 20 microns diameter is left in the developer mixture.

For the hot roller fusing apparatus described for the present invention, it has been found that higher quality for line copy is available when the toner particles have a size in the range of about 5 microns to about 20 microns with the median size by volume of about 12.0 microns, that the coarse content by volume not more than about 5.0 percent greater than about 20 microns, and that the fine content by number not less than about 13.5 percent less than 5 microns. Such a fusing apparatus may have its lower heater roller 68 coated with Teflon® material (trademark of the E.I. DuPont Corp.) as the outer layer thereby providing a relatively hard surface for the fusing function.

In Fig. 2, the image transfer arrangement and circuitry is illustrated along with the detack device 52. As shown, the biased roller 40 is electrically connected to the high voltage, positive d.c. power supply 80 which is adapted to apply 1-5 kv potential to the roller for providing approximately +25μA of current for the transfer function by this roller. The corona emitting transfer device 48 has its coronode wire 81 connected to the high voltage, positive d.c. source 82 to having impressed thereon a potential of 4-8 kv

at +90μA. The foregoing polarities are utilized since it is assumed that the toner particles have a negative electrostatic charge and the photoreceptor 22 would have been charged with a positive charge by the corona emitting device 24. It will be understood that these polarities may be reversed and coordinated in the usual manner in the event the toner particles have a positive charge and the latent electrostatic image is of negative polarity.

The device 48 includes a shield 83 made of a suitable non-conducting material and a plurality of thin guide elements 84 which are mounted across the open end of the device 48. The shield surrounds the coronode wire 81 almost completely except for one side which faces the photoreceptor belt 22. The elements 84 are made from suitable conductive material and serve to prevent the leading edge of each sheet of paper from entering the cavity of the shield after being transported through the nip between the roller 40 and the roller 26 with belt 22 and brought under the device 48.

The shield 83 is electrically connected by way of resistor/capacitor device 85 to the return side of the power supply 82. Similarly, the elements 84 are electrically connected to the supply 82 by way of a resistor 86, and is impressed with a potential approximately +1.0 k.v.d.c. The elements 84, by being electrically biased, eliminates the charges being built up on the elements during machine use. Build up of such charges tend to create unevenness of the transfer charge placed upon the photoreceptor 22 by the transfer corona generating device 48. By virtue of the above-described circuit for the elements 84, the latter become self-biasing during operation.

In the art of electrostatic printing, as in the art of photography, the quantitative measure of processing is "density". In the case of the former however, use of "reflection density" as the measure is more relevant since the object of measurement is an opaque reproduction or copy. As is well known in the reproduction field, reflection density is defined as

$D = \log_{10} \quad I_1/I_2$ wherein

I_1 is the measuring incident beam directed upon the test surface of an opaque copy while I_2 is the reflected beam from the test surface. For a xerographic copy, that is, a fixed toner image upon support material such as paper, reflection density is a measure of the quantity of the fixed tone on a surface viewed by reflected light.

In conventional xerographic machines, density is usually controlled by the variance of various parameters associated with the development ma-

terials and the electrical biases utilized in xerographic processing. More particularly, the relationship of toner particles to their supporting carrier beads has been the area which allows the most effective means for density variation or control. This relationship may directly involve the toner particle sizes and distribution in a developer mixture.

The triboelectric relationships between toner particles and carrier beads is also a factor in conventional xerography. Of the many possible variations which may be chosen and employed, care must be taken to avoid or minimize any deterioration of other quality factors which may be impacted by one or more choices. The effect of an impact on one aspect of quality may be more damaging than the gain on another aspect resulting from a choice of parameters. In any event, the controllable parameters of development materials in conventional xerography and the amount of toner present in a mixture have been such that a resulting density of approximately 1.0 has become the norm for high quality copying.

Generally, the amount of toner in a developing mixture is predetermined in accordance with the capability of the reproduction machine in producing copies of acceptable quality. Beyond this point, the adding of additional toner is not conventional since known factors which adversely affects quality, such as an increase in background, smearing, etc. will appear.

With use in the present invention, however, it has been found that the adding of more toner particles to a mixture of developing materials having the particle size and distribution discussed above produced a still higher quality of copy printing not envisioned by conventional use and experimentation. As stated above, merely adding toner particles to standard developing mixtures beyond preset amounts determined by empirical data will increase the number of background particles, a prospect which seriously lessons quality. An excess of toner particles also increases the presence of toner particles in the adjacent atmosphere which, in turn, may eventually result in quality degradation.

Additional toner particles are utilized in the mixture described above in amounts which will result in a solid area density of approximately 1.3 for copy printing. It has been found by extensive testing, that this additional toner to the mixture did not impact other aspects of quality, and that the achievement of a density of approximately 1.3 produced copy printing of solid areas with quality far superior to the quality of copy printing exhibiting a

density of 1.0. It has also been found that the transfer efficiency for solid area coverage increased significantly, approximately 20%, than what was achievable with bias roll transfer only and with the conventional toner content in conventional developer mixtures.

From the foregoing it will be apparent that there is disclosed a toner particle size distribution in conjunction with a transfer system having increased transfer efficiency of 20% that provides greatly improved line copy characteristics (minimizes blur and hollow character) and, in conjunction with higher output density (1.3) yields exceptional solid area quality.

It will also be appreciated that very high quality copies of original may be achieved from electrostatogrpahic reproduction machines employing a system of various features and aspects including the use of a dual transfer arrangement of the type described, a specific toner particle size and distribution and soft roll fusing wherein a pressure roller is made deformable relative to a fuser roller and the latter is made conformable to toner pile configuration.

CLAIMS:

1. An electrostatographic processing system having developer mixture of finely-divided toner particles electrostatically clinging to the surface of carrier particles; a corona device (24) for uniformly charging the photosensitive surface prior to production of an electrostatic latent image; a development apparatus (34) for developing the latent image; a transfer station (39) whereat support material is placed into contact with the photosensitive surface (22) bearing a developed image for receiving the same, said transfer station having a corona generating means having an electrode (81) adapted to spray ions upon the adjacent side of the support material for effecting transfer of toner particles from the developed image to the support material, characterized in that the toner particles have a particle size distribution with a median diameter by volume of about 12.0 microns, with not more than 8% by volume having a diameter greater than 20 microns and not more than 20% by number having a diameter less than 5 microns.

2. A system according to Claim 1 in which the ratio of toner content to carrier is such that there is a solid area reflection optical density of fixed images on the support material of about 1.3.

3. A system according to Claim 1 or 2 in which 1 to 5% by volume of the particles have a diameter greater than 20 microns and 0.5 to 13.5% by number of the particles have a diameter less than 5 microns.

4. A system according to Claim 1 or 2 in which the transfer station also has an electrically biased roller (40) arranged for contacting the adjacent side of the support material as the same passes through the transfer station for effecting the transfer of toner particles from the developed image to the support material.

5. A system according to any preceding Claim including an image fixing station (56) comprising a fusing apparatus having a pressure roller (70) in contact with heated fuser roller (68) to form a nip through which the support material is transported, said fuser roller (68) having an outer layer (91) made from material being conformable with toner height configuration and said pressure roller (70) being deformable at the nip during fusing contact with said fuser roller.

6. A system according to Claim 5 in which said fuser roller (68) has a surface coating made from a fluoroelastomer based on the copolymer of vinylidene fluoride and hexafluoroproxylene.

7. A system according to Claim 5 or 6 in which said nip has a width approximately ¼ to 1/6 the diameter of one of the rollers.

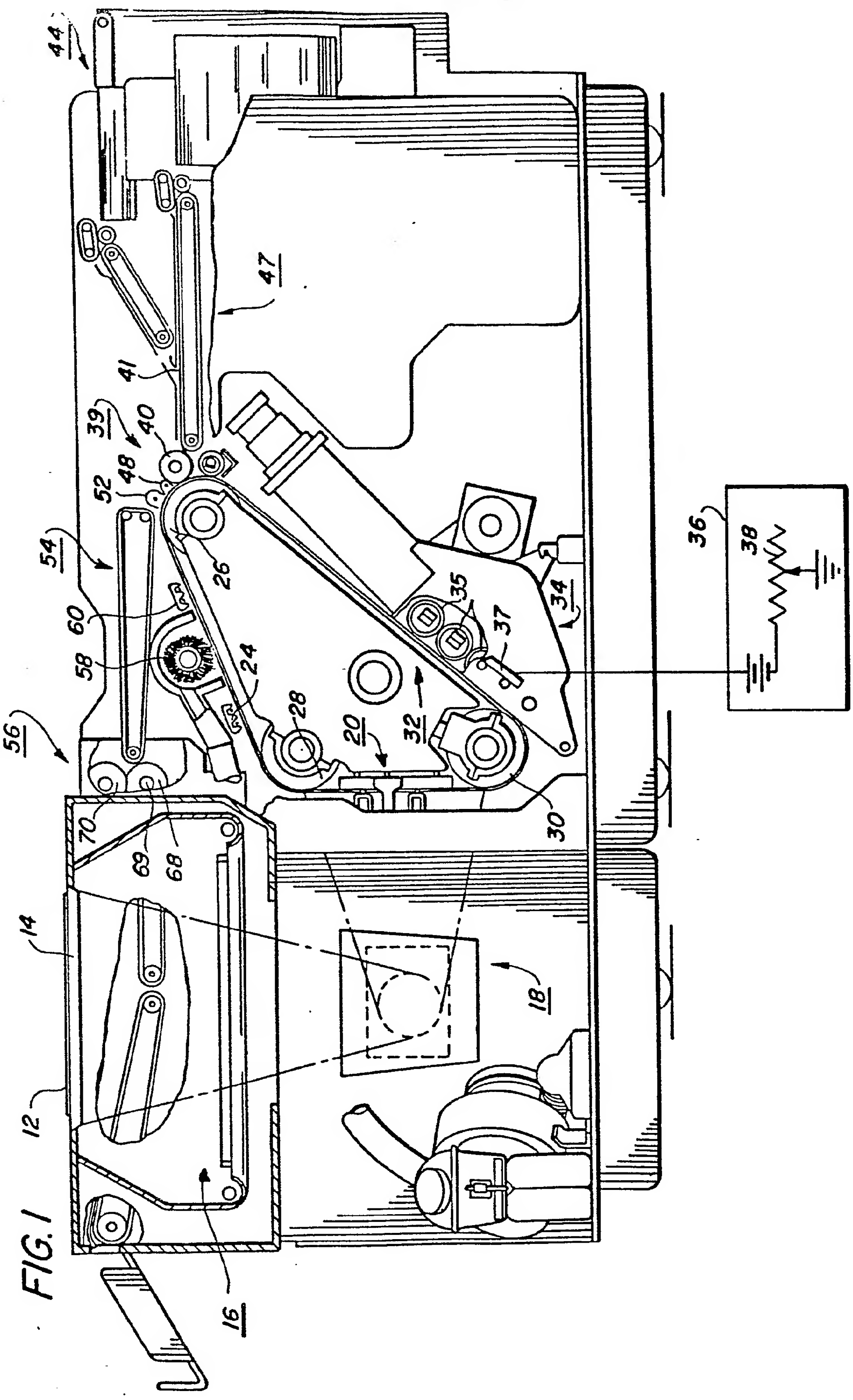
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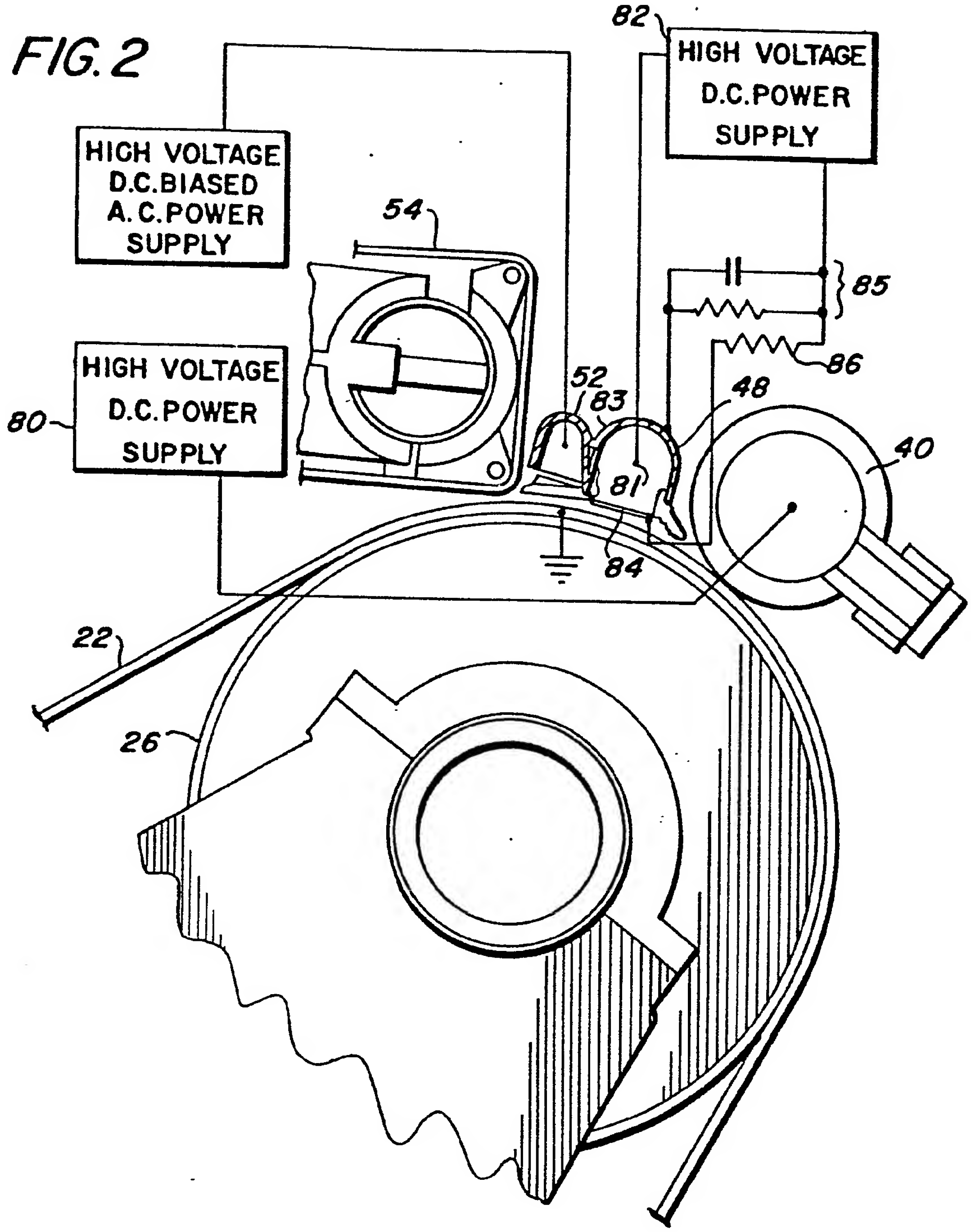
FIG. 1

FIG. 2


HIGH VOLTAGE
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A.C. POWER
SUPPLY
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HIGH VOLTAGE
D.C. POWER
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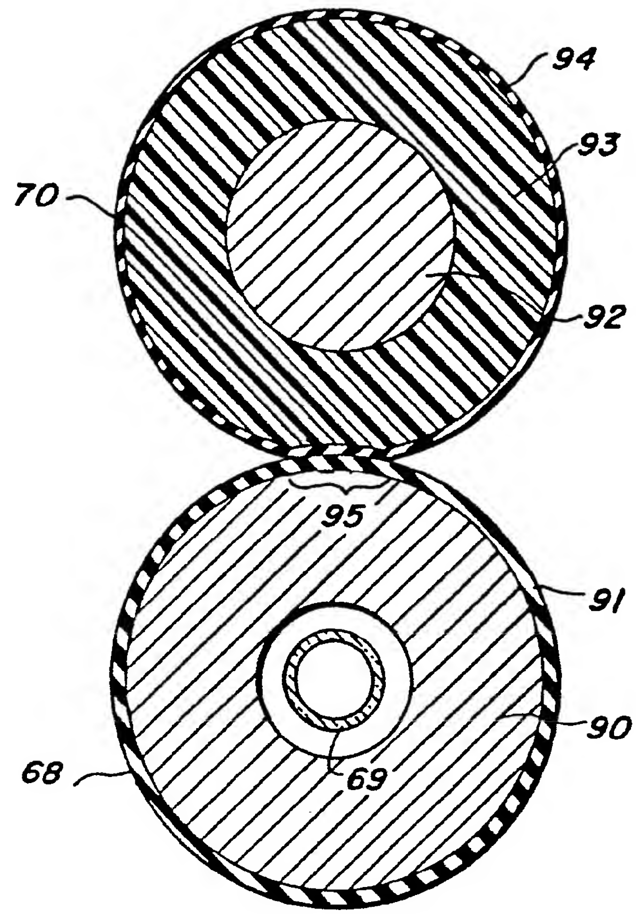
FIG. 3



European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 79 302 077.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	DE - A1 - 2 727 890 (XEROX) * claim 10, page 8 , lines 5 to 7 *	1
D	US - A - 3 969 251 (XEROX) * claims 1, 8, 9 *	1
	US - A - 3 942 979 (XEROX) * claims 1, 8, 9 *	1
P	EP - A1 - 0 001 785 (IBM) * claim 1 *	1
D	US - A - 4 027 960 (XEROX) * fig. 1 *	1,4,5
D	US - A - 4 083 092 (XEROX) * claims; fig. 2 *	5-7
A	US - A - 3 615 398 (XEROX) * column 3, line 70 to column 4, line 26 *	1
A	DE - B - 1 937 651 (MINNESOTA MINING AND MFG) * claims 1, 3; schedule columns 5 and 6 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

G 03 G 15/16
G 03 G 9/10

TECHNICAL FIELDS SEARCHED (Int.Cl.³)

G 03 G 9/00
G 03 G 13/00
G 03 G 15/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	24-01-1980	HOPPE